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THE PRODUCTION AND CONSUMPTION OF THE PRECIOUS METALS.

THE vast accumulation of economic statistics has had little effect upon economic theory. Prices, wages, interest, rent, have each been the subject of searching statistical inquiries; still the theoretical treatment of these topics goes on along abstract lines, as in the days of Adam Smith. All deductive reasoning must proceed from a few axiomatic propositions of an empirical character; so political economy virtually assumes the sufficiency of a few crude observations, while systematic collections of economic acts are available for scientific interpretation.

Referring, in particular, to the subject of money, we have heard, on the one hand, that gold and silver are commodities, and that their value is determined as that of any other commodity; on the other hand, it is argued by the advocates of the quantitative theory that the volume of money in circulation determines its value. The depreciation of silver is attributed by some to improved methods of mining, by others, to demonetization. Deductive arguments have been exhausted on both sides without advancing the question to a theoretical agreement. Practically this question has ceased to be an "issue," and is therefore open to a dispassionate examination.

It is not the object of this paper to prove or disprove a theory, or to offer a new solution, but merely to sift and weigh the evidence which was gathered while the controversy was in progress, with a view to ascertaining what we know and what is mere speculation.

The primary source of all exact knowledge on the subject of the precious metals and coinage is the *Reports of the Director of the United States Mint*. In the beginning of the past century the annual reports of the director of the mint did not exceed a few pages in the *Report of the Secretary of the Treasury*. A brief reference to the sources of production of the precious metals

occurs first in the report for the year 1824, but the information is inexact and incomplete, and is, moreover, confined to gold and silver deposited at the mint for coinage. Tabular statements first appear in the annual report for 1832; the report for 1836 contains, for the first time, in an appendix, a summary of the operations of the United States mint since its foundation in 1793. In the report for 1853 we find the first attempt to bring in a general discussion of the money question. No reference is made to the monetary systems of foreign nations until the year 1857. In 1866 Congress appropriated \$10,000 for the collection of statistical data relating to the production of gold and silver in the United States, but the work was not organized until the passage of the coinage act of 1873. By that act a bureau of the mint was created at Washington, whose duty it is, among other things, to collect statistics of the world's production of gold and silver.

Some data were published in the annual report for 1874, but they were merely in the nature of estimates, in which the director himself, Dr. Linderman, placed little reliance. Since that time the work has gradually developed. Since 1880 a special *Report upon the Production of the Precious Metals* has been published annually, apart from the *Annual Report of the Director of the Mint*. Since 1893 the Austrian ministry of finance has, from time to time, published *Tabellen zur Währungs-Statistik*; beginning with the year 1896, the French Administration des Monnaies et Médailles has published annual reports upon the same plan as the United States Bureau of the Mint. Still, except the information relating to domestic production and coinage, all other data contained in the Austrian publication and, until recently, in the French report as well, are mere reproductions of the figures published by the United States Bureau of the Mint.

All original information relating to domestic production and consumption is obtained partly from official registration of imports and exports and the operations of the United States mints and assay offices, partly by circular letters sent to various persons and institutions in the United States. Information relating to

foreign countries is taken from official publications, or procured by correspondence with foreign governments, through the regular diplomatic channels. What an amount of work the undertaking entails upon the bureau may be judged from the fact that, in 1899, 44,690 circulars were sent out from the bureau merely to ascertain the consumption of gold and silver in the industrial arts in the United States; 31,588 replies were received.

Like nearly all government statistical publications, the reports of the director of the mint confine themselves to the presentation of raw material, refraining from all comment upon the figures collected. The further tables have, with few exceptions, been prepared for these papers from the material contained in the reports of the director of the mint. Generally the figures are reproduced for a series of years in every annual report; in many cases, however, it has been necessary to go back to the original reports in order to extract the information sought for each year. This explanation is made in order to dispense with countless references to the pages of the official reports.

GOLD.

I.

There is no system of government registration of the mining production in the United States, such as is adopted in other countries. The annual output, as reported by the Bureau of the Mint, embraces only the refined product gained from domestic ores; gold ore, the product of the mines, is treated as raw material for gold refining.

Most of the refined product of domestic origin, as well as of the foreign product brought to this country, finds its way to the United States mints and assay offices. Any person may deposit gold bullion at a mint or assay office and receive in exchange gold coin or mint bars; a small charge is made for refining and alloying; there are no charges on refined gold of standard fineness.

The estimate of the annual production of the United States is obtained from two calculations, one based on production, the other on consumption.

The first calculation goes back from the refined product to the raw material, which is classed as follows : (1) unrefined gold bullion, deposited at the mints and assay offices, (2) the estimated fine contents of gold ores exported for reduction abroad, (3) gold refined at private refineries. The figures of the first subdivision are absolutely authentic in so far as they register the quantity of metal weighed, assayed, and entered in the books ; yet the classification by origin of the metal is based upon information furnished by the depositors, and is therefore subject to error. The figures of the second subdivision are likewise obtained by registration at a government institution, viz., the custom house ; still the fine contents of the ores so registered are a matter of conjecture, which can be verified only after refining, *i. e.*, abroad ; no information is available as to the further disposition of the exported ores. The figures of the last subdivision are obtained in reply to circulars sent out by the bureau ; this method leaves the most room for error.

The second calculation, based on consumption, embraces (1) all gold bullion, refined as well as unrefined, deposited at the mints and assay offices ; (2) the estimated fine contents of gold ores exported abroad ; (3) private refinery bars exported abroad ; (4) private refinery bars sold for consumption in the industrial arts. The figures of the second subdivision are identical with those embraced in the first calculation. The figures of the first and the third subdivision are absolutely authentic as to quantity, being obtained by registration at a government institution ; the classification as to origin is subject to error, however, as explained above. The figures of the last subdivision are still more susceptible to error.

Still, when the results of both calculations are compared, we find the discrepancy between them surprisingly small, as appears from the following table :

Year.	Discrepancy	
	Ounces Fine.	Percentage of Total.
1899 - - - - -	4,806	0.14
1900 - - - - -	5,865	0.15

In order to determine the maximum limit of error in the estimates of the Bureau, we should add the small quantity of gold ore exported for reduction, since it enters into both calculations. The maximum limit of error would then appear as follows :

Year.						Maximum Error. Ounces Fine.	Percentage of Total.
1899	-	-	-	-	-	5,861	0.17
1900	-	-	-	-	-	9,248	0.24

Thus the error in the estimate of the bureau is but a fraction of 1 per cent. of the total, and does not go beyond the last four decimal places of the total expressed in fine ounces, or the last three decimal places, if it is expressed in kilograms. The result is certainly very satisfactory.

The bureau of the mint takes the average between the two totals as the nearest approximation, and retains all decimals to the last place, as customary in nearly all United States and British official publications. It is obvious, however, that the last figures are purely imaginary, and therefore misleading, inasmuch as they suggest an exaggerated notion of the exactness of the result. A great deal of effort is wasted in the presentation of these more than useless decimals.

Retaining only those figures which appear in the total of each calculation and substituting ciphers in place of all others, we obtain the following estimates of the gold production of the United States for 1899 and 1900 :

Year.		Ounces Fine.	Kilograms.	Value.
1899	-	3,430,000	107,000	\$71,000,000
1900	-	3,830,000	119,000	79,000,000

The figures of the gold production of foreign countries do not claim the same exactness as the estimate for the United States. In most countries no special statistics are collected on the subject; in such cases the total production is obtained by adding together the quantity of gold coined annually and that exported abroad, with an allowance, where possible, for local consumption in the industrial arts. The export figures are far from reliable; in some countries the exports of the precious metals are given in one item, and can therefore not be utilized

at all. The world's production for 1899 and 1900, according to estimates, was as follows :

Year.			Kilograms.	Value.
1899	-	-	461,000	\$306,000,000
1900	-	-	385,000	256,000,000

The total for 1899 is thought to be not more than 3 per cent. short of the actual production. The year 1900 was an abnormal year ; owing to the Boer war, the output of South Africa fell from 110,000 to 13,000 kilograms. Now, the war being over, the Transvaal will soon regain its place among the chief gold producers of the world. Therefore, in studying the state of gold production at the close of the nineteenth century, the year 1900 should be eliminated as a disturbing factor.

All gold-producing countries can be divided into three groups, the first embracing South Africa, Australia, and the United States ; the second Russia, British America, British India, Mexico, and China ; and the third including all other nations. The annual production for 1897-99 was distributed among these three groups as follows :

Group.			1897 Per Cent.	1898 Per Cent.	1899 Per Cent.
I	-	-	71.3	73	73
II	-	-	21.4	22	22
III	-	-	7.3	5	5
Total	-	-	100	100	100

We see that the relative position of these three groups within the last three years remained constant. At the same time the production of the several countries, as well as the total, showed considerable changes, as will appear from the following table :

Country.			1897.	1898.	1899.	1900.
(In thousands of kilograms.)						
Africa	-	-	88	121	110	13
Australia	-	-	97	98	119	111
United States	-	-	86	97	107	119
Russia	-	-	35	38	33	30
British America	-	-	9	21	32	42
British India	-	-	12	12	13	14
Mexico	-	-	11	13	13	13
China	-	-	9	8	8	8
All others	-	-	26	28	26	35
Total	-	-	355	431	461	385

We see from this table that within the triennial period 1897-99 Australia and the United States showed steady growth; the progress of Africa was still more marked, the decline in 1899 from the total for the preceding year being the result of hostilities in South Africa, which closed up the mines for the last quarter of the year; the total for 1899 was virtually the output of only three-quarters of the year. It must be noted in this connection that the Transvaal furnished, even in 1899, 98 per cent. of the entire African product. Of the minor gold-producing countries, British America suddenly sprang into prominence, having outrun China, Mexico, and British India and equaled Russia; all other countries remained stationary. The same conditions continued in 1900, except in so far as they were affected by the war. The rapid growth of the gold production is manifested by the fact that, with the chief producer out of the field, the product of 1900 was still ahead of that of 1897. Owing to a decline in Australia, the United States took the front rank among gold-producing countries, being, however, still short of the Transvaal standard of 1898; British America outran Russia, thus gaining the first place among the minor gold-producing countries.

The distribution of the production by political divisions gives the following interesting results :

Nations.	1897.	1898.	1899.
	Per Cent.	Per Cent.	Per Cent.
British empire with Transvaal	54	59	60
United States - - -	24	23	23
All others - - -	22	18	17
Total - - -	100	100	100

This table shows that the British empire supplies over one-half, and the United States nearly one-quarter, of the world's gold production. In other words, the London and the New York exchange control five-sixths of the annual gold output of the world.

A comparison with former years shows that the production of 1899 was more than double that of 1892, in which year the output for the first time exceeded the annual average of the California

gold-craze period. The further difference should also be noted that these results are today obtained from working low-grade ores, which has become profitable owing to improvements in technical processes.

II.

The consumption of gold for the needs of circulation in the United States, within the last four years, outran the domestic production, as shown in the following table :

Year.			Production.	Coinage.
1897	-	-	\$57,000,000	\$76,028,485
1898	-	-	64,000,000	77,985,757
1899	-	-	71,000,000	111,344,220
1900	-	-	79,000,000	99,272,943

This is not a casual phenomenon; beginning with 1873, in fifteen out of twenty-eight years the coinage exceeded the domestic production. In 1881 the shortage was greater than in 1899, and in 1894 as great, viz.:

Year.	(1 = \$1,000,000.)		
	Production.	Coinage.	Shortage.
1881	- 35	97	62
1894	- 40	80	40
1899	- 71	111	40
<hr/>			
Total for 1873-1900	1,155	1,408	253

In other words, the domestic production of the United States supplied about five-sixths (82 per cent.) of her demand for gold coinage. The deficiency was supplied from other sources. The condition in Great Britain, with her colonial empire, within the last four years is presented in the following table :

Year.	(1 = \$1,000,000.)		
	Production.	Coinage.	Surplus.
1897	- 69	46	23
1898	- 89	68	21
1899	- 112	90	22
1900	- 115	113	2

It appears from the foregoing figures that the gold production of the British empire is in excess of the demands of its circulation; within the three years preceding the war the surplus remained constant while production was rapidly growing, which

would show that the entire increase was absorbed by the circulation of the empire; in 1900, under the strain of the war, the surplus was nearly wiped out, still the supply from the British colonies was sufficient to meet the increased demands of circulation. With the production of the Transvaal added, the British empire will be assured a large surplus of gold, far beyond the needs of its own circulation.

With the exception of Mexico and China, which are silver-standard nations, the gold production of all other countries is too small to satisfy the demands for gold currency.

The relation between the world's production and coinage since 1873 is shown in the following table :

Calendar years.	Coinage.	Production.
1873.....	\$257,630,802	\$ 96,000,000
1874.....	135,778,387	91,000,000
1875.....	195,087,428	98,000,000
1876.....	213,119,278	104,000,000
1877.....	201,616,466	114,000,000
1878.....	188,386,611	119,000,000
1879.....	90,752,811	109,000,000
1880.....	149,725,081	106,000,000
1881.....	147,015,275	103,000,000
1882.....	99,697,170	102,000,000
1883.....	104,845,114	95,000,000
1884.....	99,432,795	102,000,000
1885.....	95,757,582	108,000,000
1886.....	94,642,070	106,000,000
1887.....	124,092,465	106,000,000
1888.....	134,828,855	110,000,000
1889.....	168,901,519	123,000,000
1890.....	149,214,965	119,000,000
1891.....	119,534,122	131,000,000
1892.....	172,473,124	147,000,000
1893.....	232,420,517	157,000,000
1894.....	227,921,032	181,000,000
1895.....	231,087,438	199,000,000
1896.....	195,899,517	202,000,000
1897.....	437,722,992	236,000,000
1898.....	395,477,905	287,000,000
1899.....	466,110,614	307,000,000
Total	5,131,001,935	3,758,000,000

It appears from this table that within the twenty-seven years since 1873 there were only seven years when the world's annual

production of gold exceeded the annual coinage of the world; the total coinage for the period exceeded the ascertained production by \$1,373,000,000, or, in an average, by \$51,000,000 per year, *i. e.*, by 37 per cent. In other words, the entire output of the gold mines was barely sufficient to supply three-quarters (73 per cent.) of the total demand for gold coinage.

This would seem, at first glance, to justify the clamor against the gold standard. In truth, however, this is but an apparent shortage, inasmuch as in reality the material for coinage is largely supplied by foreign coins, or worn and uncurrent domestic coins.

III.

Considering, in particular, the quantity of foreign coin remelted at the mints, comparable data are available only for the United States, Austria-Hungary, and Germany, and these do not extend farther back than 1892. In the table below they are collated with the coinage figures:

(1 = \$1,000,000.)

YEAR.	UNITED STATES.		AUSTRIA-HUNGARY.		GERMANY.	
	Total Coinage.	From Foreign Coin.	Total Coinage.	From Foreign Coin.	Total Coinage.	From Foreign Coin.
1892.....	34.8	6.5	14.0	3.0	8.9	0.9
1893.....	57.0	12.6	55.9	40.7	26.3	0.4
1894.....	79.5	1.8	40.4	12.5	37.4	7.3
1895.....	59.6	1.2	18.2	15.6	25.6	12.8
1896.....	47.0	15.4	33.9	15.2	25.1	9.0
1897.....	76.0	14.7	33.6	16.3	30.1	15.3
1898.....	78.0	57.1	14.4	6.5	42.7	21.9
1899.....	111.3	19.1	5.0	1.0	33.6	9.1
Total	543.2	128.4	215.4	110.8	229.7	76.7

We see that the total amounts of coinage, as well as the quantities of foreign coin melted at the mints, are subject to violent fluctuations from year to year, and differ widely for every country. This is quite plain, since the volume of coinage is determined, not alone by the development of circulation, where a certain degree of regularity may be surmised, but also

by legislative enactment, which is not subject to periodicity. Thus, *e. g.*, the large quantities of coinage executed in Austria-Hungary in 1893 and 1894 were directly due to the introduction of the new currency system. This likewise accounts for the unusually large quantity of foreign coin remelted in 1893; it was the coins of the independent German states which had been current in Austria-Hungary by virtue of previous conventions, until the passage of the currency act of 1892.

Taking the eight-year period, 1892-99, as a whole, the percentage rate of the quantity of foreign coin remelted to the total coinage executed in each country was as follows :

In the United States	-	-	-	-	-	-	-	24 per cent.
In Austria-Hungary	-	-	-	-	-	-	-	51 per cent.
In Germany	-	-	-	-	-	-	-	33 per cent.

In round numbers, foreign coin supplied in the United States about one-quarter of the material for domestic coinage, in Austria-Hungary about one-half, and in Germany about one-third.

For all other nations, the total quantity of foreign coin melted within the same period, according to reports received at the United States bureau of the mint, aggregated \$18,400,000. The information is incomplete and plainly unreliable. Analogies with those three nations for which reliable data have been available are precluded by the dissimilarity of the results ascertained in each case.

With relation to the United States, information on the subject in question goes back as far as 1873. A comparative statement of the total coinage and the quantity of foreign coin melted is presented in the following table.

It appears from this comparative statement that the quantity of foreign coin remelted, as well as its ratio to the total coinage, is subject to violent fluctuations from year to year; in 1873 the ratio was 1.5 per cent., in 1880, 72 per cent., in 1881, 70 per cent., in 1888, 50 per cent., in 1898, 73 per cent., etc. The result is quite different if the comparison is made by cycles of sufficient length to include years with maximum, minimum,

Fiscal Years.	Total Gold Coinage.	Foreign Coin Melted.
1873.....	\$ 35,249,337	\$ 518,542.14
1874.....	50,442,690	9,313,882.47
1875.....	33,553,965	1,111,792.26
1876.....	38,178,963	2,111,083.80
1877.....	44,078,199	2,093,260.73
1878.....	52,798,980	1,316,461.09
1879.....	40,986,912	1,498,819.71
1880.....	56,157,735	40,426,559.63
1881.....	78,733,864	55,462,385.74
1882.....	89,413,447	20,304,810.78
1883.....	35,936,928	6,906,083.80
1884.....	27,932,824	9,095,461.45
1885.....	24,861,123	7,893,217.77
1886.....	34,077,380	5,673,565.04
1887.....	22,393,279	9,896,512.28
1888.....	28,364,171	14,596,885.03
1889.....	25,543,910	4,447,475.99
1890.....	22,021,748	5,298,773.93
1891.....	24,172,203	8,256,303.80
1892.....	35,506,987	14,040,187.70
1893.....	30,038,140	6,293,296.33
1894.....	99,474,913	12,386,406.81
1895.....	43,933,475	2,278,614.07
1896.....	58,878,490	3,277,409.06
1897.....	71,646,705	13,188,013.86
1898.....	64,634,865	47,210,077.84
1899.....	108,177,180	32,785,152.48
1900.....	107,937,110	18,834,495.53
1901.....	99,065,715	27,906,489.13
Total	\$1,484,191,238	\$384,372,020.25

and average ratios. In the following table the 29-year period under consideration is subdivided into three periods, ending respectively in 1881, 1891, and 1901 :

PERIODS (FISCAL YEARS).	TOTAL COINAGE.	FOREIGN COIN MELTED.	
		Amount.	Percentage of Total Coinage.
1873-1881.....	\$430,180,645	\$113,852,788	26
1882-1891.....	334,717,013	92,369,090	27
1892-1901.....	719,293,580	178,150,142	25
Total.....	1,484,191,238	384,372,020	26

This table demonstrates that if the figures are summed up for longer periods, the fluctuations of the totals do not affect the ratio of foreign coin remelted to the entire amount coined ; the

ratio remains practically constant, the deviations from period to period being only 1 per cent. above or below the average for the entire time considered.

Thus one-quarter of the material consumed in coinage was supplied by foreign coin, whereas the average production of the United States within the same time was only one-sixth short of the amount coined; in other words, the quantity of foreign coin deposited at the United States mints more than made up for the apparent insufficiency of domestic production for the needs of circulation.

The average consumption of foreign coin by the mints of Austria-Hungary and Germany, as stated, was higher than in the United States. If the lowest ratio (26 per cent.) is assumed as the average for the world's consumption, the deficiency in the world's production (27 per cent.) is nearly covered; still, with the present state of statistics, this is a mere guess.

IV.

Next to foreign coin, worn and uncurrent domestic coin is also used as material for new coinage. In the United States this item is of far less importance than the former. Until 1873 worn gold pieces circulated without limitation, as though of standard weight. By the Act of February 12, 1873, the limit of tolerance on gold coins was set at $\frac{1}{2}$ per cent. of the standard weight; if the wear exceeds the limit of tolerance, the gold piece is no longer legal tender and must be recoinced. In consequence of this act, in 1873, \$27,116,948 of worn coin, found upon examination in the treasury vaults, were recoinced, and in the next year \$6,275,367 were retired from circulation and recoinced. Since then the annual recoinages have been insignificant; the minimum, in 1879, was as low as \$198,083; the maximum, in 1894, reached \$2,093,615. Further particulars are given in the following table:

Fiscal Years.	Amount of Recoinage—		Annual Average.
	Total.	Per Cent.	
1873-1874	\$33,392,315.56	62	\$16,696,158
1875-1901	20,686,954.73	38	766,183
In all	54,079,269.29	100	.....

The ratio of domestic recoinages for the period 1873-1901 to the total coinage for the same period (stated above) was 3.6 per cent. The ratio was affected by the abnormal figures for the years 1873 and 1874; to eliminate this accidental cause, comparison is made below for the period 1875-1901 :

Total coinage	-	-	-	\$1,398,499,211
Recoinage	-	-	-	20,686,955
Ratio	-	-	-	1.5 per cent.

It is evident that worn domestic coin furnishes but little material for the mints. Indeed, the coefficient of wear of gold coin is infinitesimal.

The recoinages of 1873 and 1874 represent the total quantity of gold coin worn beyond the limit of tolerance since the establishment of the United States mint in 1793. Within the eighty-year period, 1793-1872, there was coined \$795,091,690 in gold. Thus the total quantity of worn coin did not exceed 4.2 per cent. of the amount coined within the same time. Still, there must have been in 1873 some coins in circulation which were partly worn at the time and reached the limit of tolerance later. Some additional allowance must be made for the wear on these coins; if it is assumed that all recoinages of the years 1875-1901 were only of such coins, and the entire wear is charged to the period 1793-1872, the amount of wear will not be underestimated. This will place the maximum ratio of worn coin for that period at 6.8 per cent.

Multiplying the amount of annual coinage by the age of the coin in 1873, the average age of all coins could be ascertained; to avoid long computations, we assume the annual coinage equal to the average for the eighty-year period, and find the average age, by means of an arithmetical progression, to be equal to $\frac{(1 + 80) 80}{2 \times 80} = 40.5$ years. The annual ratio of worn coin will then be equal to $\frac{6.8}{40.5} = 0.17$ per cent. of the amount annually coined.

It means that at this rate all coins will have been worn beyond the limit of tolerance within 588 years from the date of coinage.

The loss of weight on each piece will usually not be much above the legal limit; thus on the annual amount coined it will

constitute a fraction equal to $0.0017 \times 0.005 = 0.0000085$, or less than 0.00001. At this rate the loss by wear during 100,000 years would be barely equal to the full weight of a gold coin. On the amount coined during the fiscal year 1901, viz. \$99,000,000, the annual loss through wear will be less than \$990. The cost of remelting and recoinage \$1,116,179 of worn gold coin was, probably, not less than \$990. The former practice of allowing all gold coins to circulate without limitation was, perhaps, the more economical.

The information relating to foreign countries, with the exception of Austria-Hungary and Germany, is fragmentary or deficient. In most countries no separate accounts of domestic and foreign coin remelted are kept at the mints.

The currency reform in 1897 in Russia created a special condition in that country; the change of the monetary unit involved the recoinage of practically the entire stock of gold of former coinages; the ratio of recoinage was, therefore, unusually high, as appears from the following table:

Year.	Total Coinage.	Recoinage.	
		Amount.	Ratio to Coinage, Per Cent.
1898 - -	\$135,788,949	\$95,910,618	70.5
1899 - -	194,481,077	48,976,655	25.2
1900 - -	83,221,525	38,642,449	46.4

A comparative statement for the United States, Austria-Hungary, and Germany has been compiled for the period 1892-99; there are no available data back of 1892.

(1 = \$1,000,000)

YEARS.	UNITED STATES.		AUSTRIA-HUNGARY.		GERMANY.	
	Coinage.	Recoinage	Coinage.	Recoinage	Coinage.	Re-coinage.
1892.....	34.8	0.6	14.0	0.4	8.9	0.08
1893.....	57.0	1.7	55.9	4.1	26.3	0.05
1894.....	79.5	1.3	40.4	2.1	37.4	0.04
1895.....	59.6	1.1	18.2	0.4	25.6	0.07
1896.....	47.0	1.9	33.9	0.4	25.1	0.12
1897.....	76.0	0.8	33.6	2.6	30.1	0.28
1898.....	78.0	1.3	14.4	1.9	42.7	5.73
1899.....	111.3	1.4	5.0	0.4	33.6	0.73
Total	543.2	10.1	215.4	12.3	229.7	7.01

It appears from this table that neither the amount of recoinage, nor its ratio to the total coinage, shows any regularity in its changes from year to year for any one state. For the entire eight-year period the ratio was as follows:

United States	-	-	-	1.9 per cent.
Austria-Hungary	-	-	-	5.7 per cent.
Germany	-	-	-	3.1 per cent.

The ratio for Austria-Hungary was thrice as high as that for the United States; this was directly traceable to the act of 1892, which introduced a new monetary unit, as shown by the figures for 1893 and 1894, when one half of the total for the period was recoined.

Notwithstanding the difference in amount and ratio of recoinage for each country, the general conclusion arrived at above in regard to the United States is fully corroborated by the figures for Austria-Hungary and Germany, viz., that worn and uncurrent domestic coin contributes but a small portion of the material for new coinage.

V.

The preceding examination has brought out the distinction existing between foreign and worn domestic coin as materials for new coinage; the wear of domestic coin enters to but a small degree into the calculations of the mints, whereas the remelting of foreign coins constitutes an important part of their operations. The distinction is blurred if both are given in one item, as is done in most countries.

There are data for a comparative study of recoinage, regardless of the origin of the coins, for the following nations, beside those considered above: Great Britain with her colonies, the Netherlands, Russia, France, and Japan; figures are available for all these countries as far back as 1892, and for Great Britain and Germany as far back as 1873. A comparative annual statement for the period 1892-99, embracing all countries named, is given in the appendix. The totals, by nations and by years, are presented on opposite page.

(1 = \$1,000,000.)

NATIONS.	COINAGE.	RECOINAGE.	
		Amount.	Ratio to Coinage, Per Cent.
British empire.....	553.1	196.5	36
Russia.....	544.7	272.9	50
United States.....	543.2	138.1	25
Germany.....	229.7	83.7	36
Austria-Hungary...	215.4	122.1	57
France.....	142.4	22.3	16
Japan.....	63.1	4.3	7
Netherlands.....	1.3	0.2	15
Total.....	2,292.9	840.1	37
BY YEARS.			
1892.....	159.0	101.2	64
1893.....	229.8	90.9	40
1894.....	226.0	44.3	20
1895.....	216.6	50.7	23
1896.....	186.8	54.8	29
1897.....	430.5	195.9	45
1898.....	389.2	201.6	52
1899.....	455.0	100.7	22

The total coinage of all other nations reported for the same period aggregated \$66,000,000, of which \$26,000,000 was reported as recoinages. Thus the preceding table embraces 97 per cent. of either item, which makes the results general for the period under consideration. Old coins, as seen, have furnished within this eight-year period 37 per cent. of all the metal for coinage. The amounts, as well as the ratio, differed widely from year to year and from country to country. If the entire period is divided, however, into two quadrennial periods, the ratio exhibits some regularity:

Years.	(1 = \$1,000,000.)		Recoinage.	
	Total Coinage.		Amount.	Per Cent.
1892-1895 - -	831	287	35	
1896-1899 - -	1,462	553	38	
Total - -	2,293	840	37	

The totals in the preceding table include the figures for Austria-Hungary, Russia, and Japan, where, during the period under consideration, monetary reforms were carried out, involving large

issues of new gold coin in place of former coins withdrawn from circulation. A recurrence of the same condition is impossible, for the reason that the gold standard has now been adopted by all the principal nations of the world. To eliminate the effects of this special condition, the figures relating to those three nations are excluded from the calculation, and the results are presented in the following table:

(1 = \$1,000,000.)

Years.			Total Coinage.	Recoinage.	
				Amount.	Per Cent.
1892-1895	-	-	653	208	32
1896-1899	-	-	816	233	28.
Total	-	-	1,469	441	30

Here again the fluctuations of the ratio from the average for the eight-year period are within the ordinary limits common to all statistical calculations. Moreover, the average for the five countries does not differ much from the average for the world obtained above (30 per cent. and 37 per cent.).

Earlier data upon the same subject are available for comparison only with regard to the United States, Great Britain (without her colonies), and Germany; the figures are presented below:

(1 = \$1,000,000.)

YEARS.	UNITED STATES.			GREAT BRITAIN.			GERMANY.		
	Coinage.	Recoinage.	Ratio.	Coinage.	Recoinage.	Ratio.	Coinage.	Recoinage.	Ratio.
1873-1881.....	464.1	130.5	28	83.3	41.2	49	316.1	21.7	7
1882-1890.....	273.1	76.9	28	126.0	68.6	54	182.7	47.8	26
1891-1899.....	572.4	152.9	27	295.8	199.0	67	243.8	84.0	34
Total.....	1,309.6	359.3	28	505.1	308.8	61	742.6	153.5	21

The ratio of recoinages to total coinage in the United States, when taken by novennial periods, is remarkably constant, notwithstanding violent fluctuations from year to year.

No such regularity is established by the figures for Great Britain and Germany. In both countries the ratio of recoinages is growing; in Great Britain more than one-half of the coinage is mere recoinage. The dissimilarity of the tendencies exhibited

by the figures for each country makes their general application to all nations open to question. Before dismissing the figures, let us first ascertain the place occupied by these three countries among the gold-standard nations. In the table below we divide the entire period into two unequal parts: 1892-1899, for which the data cover 97 per cent. of the world's coinage and recoinage, and 1873-91, where the information is confined to the three nations named:

(1=\$1,000,000.)

Nations.	1873-1891. Coinage.	1892-1899.		
		Coinage.	Recoin- age.	Per Cent.
All	2,838	2,293	840	37
The three named : Amount.....	1,445	1,036	418	40
Per cent.....	51	45	...	..

It appears from the foregoing table that throughout both periods the three nations named held practically the same place among the gold-standard nations of the world, controlling as they did about one-half of the world's coinage (51 and 45 per cent. respectively). Furthermore, the ratio of recoinages in these three countries, within the period 1892-99, was practically the same as throughout the world (40 and 37 per cent. respectively). Whether this similarity extended to the previous period, 1873-91, is a matter of conjecture; the aggregate coinage and recoinage for those three countries are presented here for reference:

(1=\$1,000,000.)

Years.		Coinage.	Recoinage.	Per Cent.
1873-1881	- - -	863.5	193.4	22
1882-1890	- - -	581.8	193.1	33
1891-1899	- - -	1,112.3	435.9	39
Total	- - -	2,557.3	822.4	32

The average ratio with regard to these three nations for the 27-year period 1873-99 is approximately the same as that

found with regard to the five nations selected above for the eight-year period 1892-99 (30 per cent.); the ratio increases, however, from one novennial period to another. Still, it must be remembered that the figures for the first period were affected, in the United States, by the Act of 1873 withdrawing from circulation all worn coin, and in Germany by the monetary reform of 1873; as a result of the latter there was coined in the course of the same year a sum equal to \$140,500,000, *i.e.*, about 44 per cent. of the total amount coined within the first novennial period; the next year all gold coins of the several federal states which had been united in the German empire were retired from circulation and recoinced into imperial currency. To eliminate these factors from our calculation the following table is prepared, embracing the 25-year period 1875-1899:

				(1 = \$1,000,000.)	
Years.			Coinage.	Recoinage.	Per cent.
1875-1883	-	-	711.0	157.8	22
1884-1891	-	-	531.3	177.1	33
1892-1899	-	-	1,036.0	418.0	40
Total	-	-	2,278.3	752.9	33

Comparing the two tables last preceding we observe a remarkable resemblance of the ratios, which indicates that the effects of accidental factors, which we have endeavored to eliminate, have been mutually neutralized in the total for a larger period. This would seem to justify the application of the ratios thus obtained to the other countries of the world; the error would probably not be very great.

VI.

The last item to be considered is old jewelry, which is also utilized as material for coinage. This item is of greater importance than worn domestic coin. During the 28-year period 1873-1900 (fiscal years) there was deposited at the mints old jewelry of the value of \$63,245,373, whereas the total amount of worn domestic coin deposited was only \$52,963,089. If, further, the years 1873 and 1874 are excluded, for reasons stated above, the deposits for 1876-1900 appear to have been as follows:

Old jewelry	-	-	-	\$61,816,801.41
Worn domestic coin	-	-	-	19,570,773.87

That is to say that under normal conditions old jewelry supplied thrice as much material for coinage as worn domestic coin. This is quite natural, since the wear and tear of jewelry consists in changes of shape, which is not the case with coin. The ratio of old jewelry to the total amount of coinage for the period 1873-1900 is equal to 4.6 per cent. Annual figures are subject to violent fluctuations. In the table below they are given, together with averages per 1,000 population, the population figures being from the *Statistical Abstract* of the United States. The sale of old jewelry presumably bears some relation to the consumption of jewelry by the people, and that is determined partly by population.

FISCAL YEARS.	OLD JEWELRY DEPOSITED AT THE MINTS.	
	Total.	Per 1,000 Population.
1873.....	\$ 774,218	\$19
1874.....	654,353	15
1875.....	724,625	16
1876.....	681,819	15
1877.....	837,911	18
1878.....	907,932	19
1879.....	837,751	19
1880.....	1,176,505	23
1881.....	1,343,480	26
1882.....	1,770,166	34
1883.....	1,858,107	35
1884.....	1,864,769	34
1885.....	1,869,363	33
1886.....	2,069,077	36
1887.....	2,265,219	39
1888.....	2,988,750	50
1889.....	3,526,597	58
1890.....	3,542,013	53
1891.....	4,035,710	63
1892.....	3,636,603	56
1893.....	3,830,176	57
1894.....	3,118,421	46
1895.....	3,213,809	48
1896.....	3,388,622	46
1897.....	2,810,248	39
1898.....	2,936,943	39
1899.....	2,964,683	39
1900.....	3,517,540	46
Total.....	\$63,245,373	..

The same by quadrennial periods :

YEARS.	TOTAL COINAGE.	OLD JEWELRY MELTED AT THE MINTS.		
		Value.	Ratio.	
	1 = \$1,000.	1 = \$1,000.	To Coinage, Per Cent.	To 1,000 Population.
1873-1876	157,425	2,835	1.8	\$ 65
1877-1880	194,022	3,860	2.0	79
1881-1884	232,017	6,836	2.9	129
1885-1888	109,696	9,192	8.4	158
1889-1892	107,245	14,741	13.8	230
1893-1896	232,325	13,551	5.8	197
1897-1900	352,396	12,229	3.5	163
Total	1,385,126	63,245	4.6	...

It appears from the preceding table that the consumption of old jewelry as material for coinage increased both in amount and ratio from period to period until 1889-92, and has since then been declining. This movement has gone apace with the rise and fall of the ratio to population, but has borne no relation to the volume of coinage. Thus in 1885-88 and 1889-92 the amount coined declined as compared with previous quadrennial periods, still the quantity of jewelry melted increased; and conversely, during the following periods, 1893-96 and 1897-1900, the amount of coinage increased, still the quantity of old jewelry melted at the mints decreased.

To make these figures comparable with those given before, the following table is offered :

FISCAL YEARS.	TOTAL COINAGE.	OLD JEWELRY MELTED.		
		Amount.	Ratio.	
	1 = \$1,000.	1 = \$1,000.	To Coinage, Per Cent.	To 1,000 Population.
1873-1881	430,181	8,038	1.9	\$18
1882-1890	310,546	21,754	7.0	41
1891-1900	644,300	33,452	5.2	48

The tendency noted above can be observed in this table as well: the absolute consumption of old jewelry increased during

the second period, while the volume of coinage decreased ; and the relative consumption expressed by the ratio to coinage decreases during the third period, while absolute consumption and its ratio to population increases.

Taking the period beginning July 1, 1893, and ending June 30, 1900, as the nearest approach to the period 1892-99,¹ the consumption amounts to \$25,780,000, or 4.4 per cent. of the total amount coined, which closely approximates the average ratio for the 28-year period (4.6 per cent.). This shows that the period 1892-99 is typical for the United States. This is the period for which the most complete data are available with regard to foreign countries.

Information concerning the quantity of old jewelry used as material for coinage is available only for the United States. Still it has been shown that the consumption of jewelry for that purpose bears some relation (though undefined) to population.

In the table below a comparison is made of the per capita coinage within the eight-year period 1892-99 in the United States and in the following foreign countries: Great Britain with her colonies, except India and Canada ;² Austria-Hungary ; Germany ; Russia ; France ; Japan ; and the Netherlands.

				Census Population, Millions.	Coinage. Amount. Per Capita. (1 = \$1,000,000.)	
United States	-	-	-	76.3	543	\$7.12
Other countries	-	-	-	364.3	1,750	4.80
Total	-	-	-	440.6	2,293	5.20

It appears from this table that the amount of gold coined per capita in the United States has been greater than in other countries. It is therefore probable that the consumption of old jewelry by the mints has not been greater abroad than in the United States. At the United States rate for the eight-year period, \$360 per 1000 population, the total consumption would

¹ It is to be regretted that the arrangement of the tables of the Bureau of the Mint is not always uniform ; some figures are given by calendar years, others by fiscal years, which is a serious drawback in making comparisons.

² Gold coinage in India is insignificant, there is none in Canada, and United States gold circulates alike with sovereigns.

amount to \$131,000,000, which is 7.5 per cent. of the volume of their gold coinage, *i. e.*, considerably higher than the corresponding United States ratio.

It has been seen, on the other hand, that the ratio of recoinage in the United States, for the period under consideration, was equal to 25 per cent., and for the three novennial periods considered above it averaged 28 per cent, while for five principal countries it averaged 30 per cent., fluctuating from 28 to 32 per cent. from one quadriennial period to another. From the absence of wide differences between the United States and other countries, as far as the ratio of recoinage is concerned, it may be surmised that the rate of consumption of old jewelry by the mints is about the same in other countries as in the United States. Assuming the United States ratio, 4.4 per cent., to be general for all countries, the sum of \$77,000,000 is obtained as the consumption of old jewelry in the countries named, for 1892-1899.

These calculations are, obviously, purely speculative; still, in the absence of more reliable data, they may be of some assistance, as will be shown further.

VII.

Having considered all items in succession which serve as materials for the mints, we may now draw the balance of the world's production and consumption of gold. Let us take the period 1892-99, for which the information is fairly complete.

If we add to the gold product of the period the quantity of old coin recoined and old jewelry melted, and deduct from the sum the amount coined during the period, the balance will represent the entire stock of new gold available for industrial use. The balance sheet follows below:

Gains.						Millions of dollars.
Production	-	-	-	-	-	1,716
Recoinage:						
(a) in eight principal countries					-	840
(b) in all others	-	-	-	-	-	26
Old jewelry melted at United States mints						26
Total	-	-	-	-	-	2,608

		Losses.	
Coinage :			
(a)	in eight principal countries	-	2,293
(b)	in all others	- - - -	66
<hr/>			
Total	- - - - -	-	2,359
Balance	- - - - -	-	249
<hr/>			
			2,608

According to this calculation, there was \$249,000,000 of gold left for industrial consumption. The chief source of error is the unknown consumption of old jewelry at the mints of the world. The only authentic information is to the effect that the consumption of old jewelry at the United States mints amounted to \$26,009,000. Allowing from \$77,000,000 to \$131,000,000 as shown above, for the consumption of all other countries, we must add an equal amount to the stock available for industrial consumption which would give a total from \$326,000,000 to \$380,000,000.

On the other hand, there is some exaggeration in the preceding account; a portion of the new gold product must have gone to increase the stock of gold bullion in the treasuries and banks of issue. What this amount was could not be learned; it is known that from December 31, 1891, to December 31, 1899, the stock of gold coin and bullion in the European banks and treasuries increased by \$362,000,000; still, how much of it was coin and how much bullion, what portion of the latter represented new gold and what portion was obtained by melting old jewelry, could not be ascertained. One thing is certain, however, viz., that if it were possible to determine the increase of the stock of gold bullion derived from the new product, this would reduce the balance found above.

Lastly, the total of the world's production is subject to error, which has been estimated at 3 per cent.; this would add \$51,000,000 both to the world's production and to the stock for industrial consumption, thus bringing up the maximum stock to \$431,000,000, or 24 per cent. of the world's production. This figure is doubtless exaggerated; it is therefore safe to assume that

within the period under consideration the industrial consumption absorbed *less than one-quarter* of the total product of gold mining; *over three-quarters* of the gold product went into the channels of circulation.

In other words, it is an indisputable proposition that during the last decade of the nineteenth century gold was used chiefly and primarily as money, and next, to but a small degree, as an ornament, or as raw material in the industrial arts, surgery, science, etc.

There are no reliable data which would permit to carry this calculation further back than 1892.

VIII.

The information is more complete for the United States. To make the results comparable with those reached above let us take first the same eight-year period, 1892-99.

When one country is considered, a new item must be introduced into the calculation, viz.: imports and exports of gold bullion and ore. The figures are given in the following table:

1= \$1,000,000.)

Years.	Imports.	Exports.	Net Imports (+) or Exports (-).
1892	3.8	0.4	+ 3.4
1893	15.2	0.5	+ 14.7
1894	3.1	0.4	+ 2.7
1895	14.7	17.8	- 3.1
1896	23.4	17.4	+ 6.0
1897	10.8	12.6	- 1.8
1898	53.0	0.3	+ 52.7
1899	24.0	0.3	+ 23.7
Total	148.0	49.7	+ 98.3

Another item on which no information is available with regard to foreign countries is the increase of the stock of gold bullion in the treasuries, banks of issue, etc. In this country practically all gold bullion is kept in the treasury (including the mints and assay offices); private individuals and banks may deposit their bullion at the treasury or at the mints and receive gold coin in exchange. The stock of gold in the hands of jew-

elers, dentists, etc., is probably very small, as it would be unprofitable to keep large quantities of gold bullion on hand, when it can be exchanged for coin and deposited at a small rate of interest with some bank, which assumes the risk of safe keeping.

Thus the increase of the stock of gold bullion in the treasury vaults practically represents the total increase in the United States. The stock of gold bullion in the United States amounted :

On January 1, 1900, to	-	-	-	-	-	-	-	-	\$143,078,146
On January 1, 1892 to	-	-	-	-	-	-	-	-	83,575,643
Increase	-	-	-	-	-	-	-	-	\$59,502,503

Still, this amount represents more than the increase of the stock of bullion from the new gold product ; the bullion on hand on January 1 of any year includes the metal melted from foreign and domestic coin and old jewelry ; the difference between the stock on hand on any two dates must therefore include the increase derived from all the sources just mentioned. To eliminate this increase, we refer to the classification of the deposits by origin ; of the total received within the period under consideration, viz. \$764,00,0000, there was deposited in bullion \$592,000,000, or 77 per cent. At this rate the increase of stock of bullion in the strict sense, *i. e.*, by gold received in bullion, is estimated at \$46,000,000.

We may now draw the balance :

Gains.		Millions of Dollars.	
Production of the United States	- - - - -	- - - - -	401
Net imports	- - - - -	- - - - -	93
Melted at the mints :			
(a) Domestic and foreign coin	- - - - -	- - - - -	138
(b) Old jewelry	- - - - -	- - - - -	26
Total	- - - - -	- - - - -	663
Losses.			
Coinage	- - - - -	- - - - -	543
Increase of the stock of bullion	- - - - -	- - - - -	46
Total	- - - - -	- - - - -	589
Balance	- - - - -	- - - - -	74
			663

Thus there was left for industrial consumption \$74,000,000, *i. e.*, 18.5 per cent. of the total production of the United States for the same period ; if the net imports are added to the production, the distribution of the total new product by modes of consumption will appear as follows :

			$\text{1}=\$1,000,000.$	Per cent.
Coinage (deducting recoinage)	-	-	379	76
Industrial consumption	-	-	74	15
Increase of the stock of bullion	-	-	46	9
Total	-	-	499	100

The only source of error in this calculation is the estimated increase of the stock of bullion. If this item is omitted, the stock available for industrial consumption would rise to \$120,000,000, *i. e.*, 24 per cent. of the aggregate production and imports. This maximum coincides with that found for the world's consumption.

The Bureau of the Mint estimates annually the industrial consumption of gold from the quantity of gold bars sold by the mints and assay offices and private refineries. The total for 1892-99, \$71,000,000, differed only by \$3,000,000 from that obtained by our calculation ; the discrepancy amounted to \$375,000 a year, or 3 per cent. Both estimates appear to be very close.

The reports contain no data earlier than 1884 available for a similar calculation. The imports and exports of gold in 1884-91 were as follows :

(1 = \$1,000,000.)

Years.	Imports.	Exports.	Net Imports(+) or Exports (-).
1884	8.7	23.1	-14.4
1885	3.7	0.8	+ 2.9
1886	17.9	27.9	-10.0
1887	19.5	1.1	+18.4
1888	1.7	25.9	-24.2
1889	1.7	40.5	-38.7
1890	2.6	16.3	-13.7
1891	11.0	4.6	+ 6.4
Total	66.8	140.2	-73.4

The stock of bullion in the treasury amounted :

On January 1, 1892, to	-	-	\$83,575,643
On January 1, 1884, to	-	-	65,667,190
Increase	-	-	\$17,908,453

The total deposits at the mints within the same time amounted to \$433,000,000, of which there were \$334,000,000 in bullion, *i. e.*, 77 per cent., the same as in 1892-99. At this rate the estimated increase of the stock of bullion was \$14,000,000.

Upon the preceding data we draw our balance :

Gains.		Millions of Dollars.	
Production of the United States	-	-	265
Melted at the mints :			
(a) Domestic and foreign coin	-	-	74
(b) Old jewelry	-	-	24
Total	-	-	363
Losses.			
Coinage	-	-	207
Increase of the stock of bullion	-	-	14
Net exports	-	-	73
Total	-	-	294
Balance	-	-	69
			363

Thus the balance available for industrial consumption amounted to \$69,000,000, or 26 per cent. of the total domestic production for the period under consideration.

The total industrial consumption for 1884-91, obtained from the estimates of the Bureau of the Mint, amounted to \$69,800,000, differing from the former total by a little over 1 per cent.; as the estimates are not reliable below \$1,000,000, this discrepancy may be treated as a negligible quantity.

In the following table the product of 1884-91 is distributed by modes of consumption :

	1 = \$1,000,000.	Per Cent.
Coinage (deducting recoinage)	109	41
Exports	73	28
Industrial consumption	69	26
Increase of the stock of bullion	14	5
Total	265	100

The only source of error, as stated, is in the last item; if it is excluded from the calculation the maximum industrial consumption will be raised to 31 per cent., while 69 per cent. was either coined or exported abroad, presumably to cover balances in international trade, where assayed gold bars are used as a sort of international currency, as it were. If the exports are deducted from the total, so as to leave the domestic product consumed at home, the maximum industrial consumption will reach 43 per cent. Thus we see that in 1884-91, as well as during the subsequent period, the chief use of gold was to satisfy the want of the community for money symbols. In the following table a comparison is made of both periods :

(1 = \$1,000,000.)

PERIODS.	PRODUC- TION.	INDUSTRIAL CONSUMPTION.		
		Total.	Annual Average.	Ratio to Production.
1884-1891	265	69	8.6	Per Cent. 26
1892-1899	401	74	9.2	18.5
Increase	136	5	0.6	4

We observe that while the eight-year product increased from one period to the other by \$136,000,000, *i. e.*, by one-half, the industrial consumption increased only by \$5,000,000, or \$600,000 per year, which is but 4 per cent. of the total increase. If it is remembered that the possible error for the last eight-year period may be as high as 5 per cent., and that fractions of \$1,000,000 are, in general, inaccurate, it may be reasonably maintained that *the enormous increase of the gold production has not affected the average consumption of gold in the industrial arts*, which did not change from one eight-year period to the other. The entire increase went to swell the volume of gold in circulation.

This conclusion agrees with what has been shown above in relation to Great Britain.

Inasmuch as the average industrial consumption has been a constant quantity, its ratio to the total production has necessarily fallen with the increase of production.

IX.

In the preceding calculations the amount of industrial consumption has been obtained by indirect process. As early as 1879 the Bureau of the Mint made an effort to study the subject by applying directly to manufacturers using gold as material. The result was unsatisfactory; the effort was repeated in 1880, 1881, 1883, 1885 and again in 1899. The latest information received is fairly complete and reliable. The collection of such statistics is attended with great difficulties. To begin with, the information is obtained from a very large number of persons; in 1899, 29,948 replies were received to interrogatories sent out by the Bureau. It is extremely difficult, often impossible, to avoid duplications, inasmuch as the product of one manufacturer is used as material by another. On the other hand, aside from newly mined gold, old gold—remelted jewelry, domestic and foreign coin—is used to a considerable extent in the industrial arts. Moreover, even gold bars specially manufactured for the trade by the mints or private refineries are made partly from old metal. Therefore the replies giving the quantity of mint and private refinery bars purchased are misleading, unless compared with the records of sales of mint bars and the available data on the sale of private refinery bars. Still, the two annual totals are not quite identical, inasmuch as a portion of the gold consumed in the arts during the early part of the year 1899 must necessarily have been melted and refined during the previous year. Thus the sum of purchases cannot agree with the sum of sales.

Moreover, the fluctuations of the stock of bullion, though of little effect when taken for a period of years, may very materially affect the results of one year; the figures for one year are therefore to be accepted with great caution.

With these qualifications let us consider the results obtained by the Bureau. According to information received, the materials used in the arts are classified as follows :

Years.				Bars and Bullion. Per Cent.	Old Jewelry and Coin. Per Cent.	Total Per Cent.
1880	-	-	-	64	36	100
1881	-	-	-	61	39	100
1883	-	-	-	57	43	100
1885	-	-	-	64	36	100
1899	-	-	-	81	19	100

The results of 1899 differ widely from those obtained previously, the average ratio of consumption of old material has declined by one-half. The difference may be due to the fact that the data previously obtained were not as complete as those secured in 1899. On the other hand, the substantial uniformity exhibited by the ratios for 1880, 1881, 1883, and 1885 argues for their accuracy. It is therefore possible that the growth of the gold production may have since brought about an increase of the proportion of new gold used. An increase from 64 to 81 per cent. in the amount of industrial consumption, when compared with the total production of the United States, would mean only about one-fourth or one-fifth of that rate. *i. e.*, about 5 per cent.; with the present methods of estimating the gold production such differences would escape observation.

Let us now compare the figures for 1899 :

				From Mints and Assay Offices.	From Private Refineries.	Total.
Sold to the trade	-	-	-	\$14,685,642	\$4,632,218	\$19,317,860
Bought by the trade	-	-	-	14,259,412	3,832,337	18,091,749
Discrepancy	-	-	-	\$ 426,230	\$ 799,881	\$ 1,226,111

Still, the total sales reported by private refineries included \$2,753,362 of mint and assay office bars sold by them to the trade in 1899; how much of it had been bought by the refineries within the same year and should, therefore, be deducted to avoid duplications, does not appear. If the entire amount is deducted, there will be an excess of purchases over sales amounting to \$1,527,251, or 9 per cent. of the sales. Considering each item by itself, we find that the excess of sales of government bars over purchases amounted to \$436,230, or 3 per cent. of the purchases; the excess of sales over purchases from private refineries

amounted to \$799,881, or 21 per cent of the purchases. Still, if the sales of government bars from private refineries are deducted, there is an excess of purchases over sales amounting to \$1,953,481, *i. e.*, the amount of all purchases is nearly double that of the sales.

It is possible that the wording and classification of the interrogatories may have misled the correspondents of the Bureau; bars bearing the government stamp, but bought from a private refinery, may in many cases have been reported as private refinery bars. On the other hand, the information of the Bureau relating to private refineries is incomplete, coming from only sixty refineries, which have since all been included in the smelting combination; still the latter has, according to its own statement, not concentrated all the refineries.

The error in the total of industrial consumption is thus somewhere between + \$1,226,111 and - \$1,527,251, or between + 7 per cent. and - 8 per cent. of the total purchases reported by the correspondents of the Bureau.

From the amount thus obtained must be deducted the value of old metal used at the mints and private refineries in the manufacture of bars. Of the amount of \$16,564,497 sold in bars during the year 1899, only \$13,267,287 was made of newly mined domestic gold. At this rate, the total reported sum of purchases, \$18,091,749, contained only \$14,500,000 of new gold. To this should be added native grains and nuggets which are bought in small quantities by jewelers directly from miners, and therefore escape all estimates of the Bureau. The replies received from consumers show a total of \$539,362. This brings up the industrial consumption of new gold in 1899 to \$15,000,000, or 21 per cent of the production of 1899. The average rate obtained above for 1892-99 was 18.5 per cent. Thus the percentage ratio, based upon replies from consumers, differs very little from the ratio found by the other two methods used above.

It might seem that comparisons would be more proper with ratios found by former methods for the year 1899, rather than

for the eight-year period 1892-99. In reality, such comparisons would be of no value, since all the elements of those calculations are subject to wide fluctuations from year to year; since the annual production and coinage exceed many times the industrial consumption, a small fluctuation of, say, 5 per cent. in either of the former might affect the latter to the extent of 50 per cent.

The substantial agreement of the results arrived at by three different methods vouches for their accuracy. In 1892-99 the ratio of industrial consumption to coinage in the United States has been shown to be, substantially, the same as throughout the world. On the other hand, it has been shown that during the preceding period, 1884-91, the ratio of industrial consumption in the United States did not materially differ from that found for the subsequent period. It may, therefore, be assumed that the condition ascertained for the United States was universal at the time stated.

X.

The preceding examination of the statistics of gold production and consumption justifies a few conclusions, which may now be briefly stated.

It has been shown that fairly complete and reliable statistics of the world's production and consumption of gold are available only since 1892; earlier figures are fragmentary and insufficient for scientific purposes.

The agitation over the currency question has rendered a valuable educational service by stimulating systematic statistical inquiry. In time it will be possible to treat the subjects of production, coinage, and consumption of gold by decennial periods. Annual figures are subject to violent fluctuations; any attempt to base conclusions upon the figures for one year must be misleading.

One proposition has been firmly established, viz., that within the last decade or two of the nineteenth century by far the larger part of the gold production, from two-thirds to three-quarters, if

APPENDIX.
COMPARATIVE TABLE OF THE GOLD COINAGE AND RECOINAGE OF THE PRINCIPAL NATIONS OF THE WORLD.
(1=£1,000,000.)

NATIONS.	1892.		1893.		1894.		1895.		1896.		1897.		1898.		1899.		Total.	
	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.	Coin- age.	Re- coin- age.
British empire.....	98.5	84.5	77.2	30.7	62.8	17.8	52.2	18.7	58.0	12.6	45.9	13.4	67.7	10.0	90.8	8.8	553.1	196.5
Russia.....	0.6	....	2.3	0.0	2.3	0.0	38.6	0.0	....	....	170.6	128.0	135.8	95.9	194.5	49.0	544.7	272.9
United States.....	34.8	7.1	57.0	14.3	79.5	3.1	59.6	2.3	47.0	17.3	76.0	15.1	78.0	58.4	111.3	20.5	543.2	138.1
Germany.....	8.9	1.0	26.3	0.4	37.4	7.3	25.6	12.9	25.1	9.1	30.1	15.6	42.7	27.6	33.6	9.8	229.7	83.7
Austria-Hungary.....	14.0	3.4	55.9	44.8	40.4	14.6	18.2	16.0	33.9	15.6	33.6	18.9	14.4	7.4	5.0	1.4	215.4	122.1
France ¹	0.9	5.2	9.8	0.7	1.9	1.5	20.8	0.7	21.7	0.2	42.7	1.9	34.2	1.9	10.4	10.2	142.4	22.3
Japan.....	1.3	....	1.3	....	1.6	....	1.5	....	1.1	....	31.6	3.0	16.0	0.3	8.7	1.0	63.1	4.3
Netherlands.....	....	....	....	....	0.1	....	0.1	0.1	....	....	....	....	0.4	0.1	0.7	....	1.3	0.2
Total.....	159.0	101.2	229.8	90.9	226.0	216.6	216.6	50.7	186.8	54.8	430.5	105.9	389.2	201.6	455.0	100.7	2,292.9	840.1

¹ The excess of the amount of coin melted in 1892 over the total coinage for the year is explained by the fact that old coin melted in one year is recoined in later years.

not more, found its way into the channels of circulation, and only a small portion was consumed in the arts.

A comparison with the earlier estimates of the late Dr. Soetbeer leads to the conclusion that the same condition has prevailed since the discoveries of gold in California and Australia.

The annual average production by decennial periods from 1851 to 1880 was between \$115,000,000 and \$133,000,000; the average for the last decade of the nineteenth century was \$210,000,000. The industrial consumption during the same period was found to be less than one-quarter of the total production, or less than \$52,000,000. Assuming the consumption of gold in the arts to have been the same in amount fifty years ago as today (which is impossible), it would still have been only from 39 per cent. to 45 per cent. of the total production of those days. In reality, the absolute quantity, and accordingly the ratio, of gold consumed in the arts must have been considerably less.

Thus, during the second half of the last century, since the opening of the great gold streams from California and Australia, gold has been used chiefly as money, and to but a small degree as a commodity. The old proposition that gold is a commodity and derives its value primarily from its use as a commodity, may or may not have been true in the eighteenth and during the first half of the nineteenth century—to prove or disprove it for that time there are no statistical data; surely it does not hold today.

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